DOCUMENT RESUME

ED 292 872 TM 011 296

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TITLE Integrating ARCS Motivational Theory into the Component Display Theory of Instructional Design.
PUB DATE 87
NOTE 21p.; Paper presented at the Annual Meeting of the American Educational Research Association (Washington, DC, April 20-24, 1987).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Learning Motivation; *Motivation Techniques; *Student Motivation; Teaching Methods
IDENTIFIERS *ARCS Motivational Theory; Instructional Theory

ABSTRACT

A two-stage study was conducted to determine the effects of motivational components in the learning experience. The first stage involved administration of a survey instrument to 150 teachers in the New York City area to obtain information on the means by which teachers incorporate motivation into their instruction. The second stage involved the administration of a hobby lesson to a student audience that reflected the integration of J. Keller's Attention, Relevance, Confidence, and Satisfaction (ARCS) motivational model into Merrill's Component Display Theory. The theory provides prescriptions for cognitive outcomes of instruction. The lesson was organized into three sections that led the students toward the task of determining the length of a dipole antenna. Results of tests administered to students before and after the lesson suggest a higher degree of attainment of the motivational objective of the lesson by those who took a version of the lesson that incorporated the motivational component. Results from administration of the lesson as well as the teacher survey suggest that the four factors of the ARCS model are intricately bound together, so that isolation of any one factor for prescription purposes may be detrimental to overall motivational effects. (TJH)

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ED292872

INTEGRATING ARCS MOTIVATIONAL THEORY INTO THE COMPONENT DISPLAY THEORY OF INSTRUCTIONAL DESIGN

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Presented at the 1987 annual meeting of
the American Educational Research Association
in Washington, D.C.

INTRODUCTION

The rise of cognitive psychology brought about much activity among instructional theorists during the 1970s and early 1980s. This activity, coupled with increased interest in training from the Defense Department, permitted continued development of instructional theory. Most of this work was, not surprisingly, in the cognitive domain.

John Keller, in 1979, however, as a result of continuing investigations into the relationship between motivation and instruction, developed the ARCS model of motivational design. In it, he postulates that there are four factors which comprise the motivation to learn: attention, relevance, confidence, and satisfaction. He further postulates that various strategies support the attainment of each factor.

Keller (1986) indicates that the model is to be used with a "...systematic instructional design process to identify the motivational profile of the audience, establish motivational objectives, design motivational strategies, and field test and evaluate them (pg 4)." He also notes the difficulty in prescribing motivational strategies, saying, "The elements of human motivation, even when narrowed to the concern for the motivation to learn...are complex and interactive which makes it difficult to create useful prescriptions. Instead, a problem solving approach, using the ARCS Model for suggestions and guidance, will help insure improved motivational properties (Keller, 1986 pg. 4)..." Still, Keller is able to describe both strategies and tactics which seem to support the motivational factors. Unfortunately, however, motivational theory and instructional theory remain two separate entities. The result is that, today, instructional designers have no means by which to integrate motivational theory with instructional theory.

In the mid-1970s, M. David Merrill developed the Component Display Theory. This evolving theory provides prescriptions for cognitive outcomes of instruction. It provides different strategies based on the nature of the content to be taught (facts, concepts, procedures, or principles) and on the level of knowledge required of the student (remember-rote, remember-meaningfully, use or skill, or find). Unfortunately, the work pays little attention to the motivation of the learner when making instructional prescriptions. The operationalization of Keller's ideas and their integration into Merrill's instructional theory thus seems a logical next step in the development of prescriptive theory for the cognitive domain. It is this integration which fuels our research effort and which led us to conduct the two studies described below.

It is our contention that instructional prescriptions should include motivational components, the purpose of which is to make the learning experience more appealing as well as more efficient and effective. To this end, we devised a two-stage study which consisted of: (1) a survey of practicing teachers to assesses their motivational attitudes and practice; and (2) the administration of an educational product to a student audience that reflected the integration of ARCS strategies into Component Display Theory. From these results, we have formalized a procedure for integrating ARCS into Component Display Theory. In addition, we have developed both an integration taxonomy and an integrated instructional blueprint (N.B. This taxonomy and sample blueprint do not address Merrill's remember level of learning, although with some modification, they could). What follows are descriptions of the development and administration of the lesson and survey, a discussion of results, presentation of our model, and conclusions of the research.

THE LESSON

The lesson was developed in association with John Bonar, the training manager of the Liverpool Amateur Repeater Club, a Syracuse, NY area amateur radio club. Lesson design was accomplished utilizing the Merrill Component Display Theory. Originally, one-on-one and small group trials demonstrated the lesson's capability to teach, but no measures of the effects of motivational strategies utilized were taken.

Thus, arrangements were made with Mr. Robert B. Daley and Mr. Grove Havener, science teachers at the Jamesville-DeWitt High School to test two versions of the lesson with their non-regents ninth grade science classes. These classes were picked specifically because the students represented minimally-motivated students who met the entry-level requirements of the lesson. With such a group, then, it was postulated that both the cognitive *and* motivational effects of the lesson itself should be most noticeable.

Based on observations of the student population, it was felt that the motivational goal of the treatment lessons should be to foster among the students a satisfaction with the learning experience such that they would consider taking more lessons about the hobby. With the motivational goal thus defined, Keller suggests that the creation of motivational objectives is in order. For the purpose of this experiment, one objective was deemed both appropriate and necessary:

> Given a lesson on determining the length of a half-wave dipole antenna, the student will choose to complete the lesson and will be willing to take additional ham radio instruction.

The lesson was organized into three sections which led the students, ultimately, towards the task of determining the length of a dipole antenna. This particular content was selected specifically because it was foreign to the students and was believed to be rather boring in nature. The lesson took the students through the theoretical underpinnings of the derivation of the formula used by radio amateurs to determine high frequency antenna length. Two versions of the lesson were administered: one version as developed using Component Display Theory only, and a second version which incorporated Keller's ARCS model.

Measures of both cognitive ability and motivation were taken at the beginning and end of the lesson. Students were required to take a pretest and a posttest which asked them to demonstrate abilities taught in the lesson and which elicited responses to questions concerning the lesson's appeal.

For example, to determine whether or not the lesson met the motivational objective (to get the students to want to take another lesson of this type), the students were asked in the pretest to rate the following question from one to seven:

> "I think I would like to learn something about the hobby of amateur radio."

In the posttest, the students were asked:

> "I think I might enjoy taking another lesson like this one."

The difference in the scores between the pre- and posttest was considered to be a measure of the motivation of the student to continue. Comparisons

between the average scores for the group which took the lesson with motivation, versus the group which took the lesson without motivation seem a logical measurement of the effectiveness (or lack of effectiveness) of the motivation strategies utilized in the lesson.

THE SURVEY

A three page survey was developed which contained twenty-five statements on motivational attitudes and practices. This was administered to approximately 150 teachers in the New York City area who were asked to rate the statements on a five point scale. Our goal was to glean realistic information on how teachers incorporate motivation into their instruction. The survey was divided into two parts; the first part was comprised of seven statements which addressed general motivational tendencies, i.e. whether teachers considered motivation to be important, whether they developed motivational objectives as well as instructional objectives, and their opinions on student response to the addition of motivation to a lesson. The second part was comprised of 17 statements which attempted to isolate the four factors which comprise the ARCS model and queried teachers on their use and placement within instruction. An example of this more specific statement follows:

> "I use techniques to get students' attention when presenting information to my students_____."

THE FINDINGS

Keller (1986) suggests that the addition of motivational strategies alone may not improve learning, and our findings supported that hypothesis. All students but one demonstrated mastery on two of the three instructional objectives. Three students demonstrated mastery on all three instructional objectives. Of the three, one was from the "with motivation" group and two were from the "without motivation" group. Also, difference scores indicate that virtually all of the students learned as much or more of what they thought they would learn at the beginning of the lesson when compared to other lessons they've taken. Thus, it is reasonably certain that if motivation is to have any effect, it will be in outcomes other than the ability of the materials to teach.

No significant differences between the groups' attainment of the motivational objective was found. Perhaps this was because the sample size was too small: An "N" of nine for the "with motivation" group and of ten for the "without motivation" group necessitates rather large swings to detect significance. Further, it seems that, for some students, it was not possible to implement the motivational strategies in a print-based medium: Several did not make honest attempts to work through the lesson or answer all the questions in the posttest. In retrospect, then, the choice of delivery system might have been better; e.g., interactive video or computer assisted instruction. It is possible, of course, that the questions were not good measures of the ARCS components as well. Lastly, it is also possible that either the lessons were simply poorly done or that the ARCS strategies do not, in fact, affect motivation.

We doubt this last possibility, however, as there is an interesting trend which was noticed and is worthy of reporting: The

average difference score for the measure indicating attainment of the motivational objective, i.e., the increase in willingness to take more lessons on amateur radio, indicates a positive shift by those who took the lesson with motivation (+0.10). Those who took the version of the lesson without the integrated motivational strategies showed a decline in their willingness to learn more (-0.20).

We think it important to note, however, that we could not discern significant effects or trends among the four separate factors of motivation. Again, this may be due to the several inherent components of the study, i.e. the small sample size, or lack of sensitivity of the research methods. However, we postulate that it may also be due to the inextricability of the ARCS components from each other; our survey findings support this hypothesis and are discussed next.

Our survey findings fell into three parts: (1) general motivational tendencies of teachers; (2) statements which attempted to isolate ARCS components in teachers' instruction; and (3) teacher comments. Analysis of tendencies supplied us with the following information:

--teachers consider motivation to be an important component of a lesson,

--teachers seldom use motivational strategies only at the beginning of a lesson,

--50% of teachers surveyed develop motivational as well as instructional objectives, and

--teachers believe students respond well to the addition of motivational material to a lesson.

Analysis of our ARCS component isolation statements did not supply us with significant results; teachers did not identify elements of Keller's model with particular parts of instruction (e.g. when presenting information, examples, or practice opportunities). There was a slight trend to identify the "attention" component with "presentation of information", suggesting that the "A" in ARCS could be prescribed for the "G" in Generality-Example-Practice of the Component Display Theory, but again, the results were not significant enough for us to generalize. Also, no similar trends were observed for the "Relevance", Confidence", or "Satisfaction" components. Teacher comments, however, revealed some interesting information; the single motivational component mentioned most often by teachers was "relevance". Statements like "Relate material to their lives", "Relating subject material to home-life", "I relate literature, to popular movies, TV programming, music, etc.", and "I ask relevant questions concerning the classroom, teacher or other students" appear most often, closely followed by suggestions of praise and reward to motivate students. Other responses include role-playing, use of games, providing feedback, and employing audiovisual equipment and materials.

THE MODEL

Based on the procedures followed during the conduct of the experiment, and as verified by the activities teachers say they conduct when developing instruction, we have developed a procedural model for integrating Keller's motivational theory with Merrill's instructional theory. It should be recognized that this model is intended for use at the micro, or individual lesson, level. The user should complete a macro, or course/curriculum, level design before using the integrated model:

1. Develop the instructional goal for the lesson.
2. Identify the motivational requirement.
3. Develop instructional objectives.
4. Develop motivational objectives.
5. Determine the instructional prescription.
6. Determine the motivational prescription.
7. Compare and integrate motivational and instructional tactics.
8. Test the design.
9. Revise the design and retest.

Step one can be accomplished from an analysis of needs assessment and other front end data available to instructional designers in most educational situations.

Step two is the designer's general statement of motivational need. This general statement should address the amount of enrichment required in each of the four ARCS factors. A number from one to five, with "one" representing little emphasis and "five" representing a great deal of emphasis, should be assigned to each motivational factor. Unfortunately, the data needed to determine the motivational requirement are not always gathered during front-end analyses. Thus, trips back to class room may be required to gather the data. Since quantifiable data on motivation has proven difficult to collect and assess, we recommend that qualitative data (observation, interview, etc) be gathered and analyzed to determine motivational requirements for the instruction under design.

Steps three and four are self-explanatory.

Step five is accomplished in accordance with Merrill's Component Display Theory.

Step six requires use of the "Prescriptions for Integration" taxonomy described at Appendix A. For each lesson component (as defined by integrating Motivational Theory's lesson structure and Component Display Theory's primary presentation forms) the motivational strategies and tactics (as suggested by Keller and modified by the authors) appropriate to that lesson component are identified. Within each lesson component, the strategies and tactics are offered in no special order. The designer, through use of the "instructional art", should select those strategies and tactics appropriate for the particular lesson and audience.

The classification of strategies and tactics developed for the "Prescriptions for Integration" was based on common sense and on what strategies seemed to work best in the various elements of the experimental lesson. We do not mean to suggest, however, that the taxonomy we have developed is complete or all inclusive. Rather, we seek and welcome comment and experimentation on our selection and placement of motivational tactics.

Step seven culminates with the use of the "Integrated Lesson Blueprint" at Appendix B. This blueprint represents the completed lesson design. Visually, the blueprint is quite similar to the blueprint used by Component Display Theory. The integrated blueprint, however, also requires specification of the lesson motivational objective and richness levels. Further, it provides the opportunity to address the motivational tactics selected for use in each lesson component, including pre- and post-instructional tactics.

Keller (1983) suggests that good instruction is often motivational in nature as well. Thus, it comes as no surprise that some of Merrill's secondary presentation forms (e.g. attention focusing, alternative representations) closely resemble some of Keller's motivational strategies and tactics. Thus, the integrated blueprint also allows for the

comparison and consolidation of the secondary presentation forms with the motivational tactics appropriate for each lesson component.

Steps eight and nine are self-explanatory.

CONCLUSIONS

Although statistical significance is not present in the experiment, an examination of pre- and posttest difference scores suggests a higher degree of attainment of the motivational objective by those who took the lesson with motivational strategies than by those who took the version of the lesson without motivational strategies. Also, results from both the experiment and the teacher survey suggest that the four factors of Keller's ARCS model are intricately bound together. Isolation of any one factor for prescription purposes may be detrimental to the overall motivational affect of the instruction. Thus, although enrichment levels may vary, all four factors of motivation should be considered when designing each lesson component.

Questions raised by the experiment are numerous. Would the results have been more significant had the sample size been larger? Would the effect have been more significant had a different, more graphic, delivery medium been used? Are qualitative measures accurate enough to determine proper motivational goals? Are the variables suggested by Keller the right ones to manipulate to achieve motivational change? And, do those variables lend themselves to prescriptive theory? Lastly, is the suggested procedure an adequate basis upon which to develop a functional integration of instructional and motivational theory?

Certainly, with the promising trend noted in the experiment, additional experimentation with the integrated model is warranted. Focused

treatments with and without motivation will help determine the theory's basic worth. Manipulations of the four factors, attention, relevance, confidence, and satisfaction will help define their relationship to each other and overall values of motivation. Finally, manipulations of the specific strategies should help to fine-tune the motivational prescriptions and make integration with instructional prescriptive theory a more meaningful enterprise than is currently possible.

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APPENDIX A

Prescriptions for Integration

Pre-Instruction

A-1 Perceptual arousal
- Prepare instructional package to elicit learner response
- Use well-designed graphics
- Use color appropriately
- Employ contrast in visuals where appropriate
- Use animation for gaining attention (in visual instruction)

A-2 Inquiry arousal
- Employ sense of mystery by presenting a problem solving situation or context of exploration

R-1 Familiarity
- Use appropriate language which will appeal to learner
- Use graphic illustrations to embed abstract or unfamiliar concepts in a familiar setting
- Provide examples with language familiar to the learner

R-2 Goal Orientation
- Provide instructions that clearly explain the lesson
- Explain the significance of studying the lesson content
- Provide the lesson objectives and an instructional map
- Tie lesson to long-range learning (if no immediate gratification is obvious)

R-3 Motive matching
- Provide flexible menus for student choice or more precise guidance for those who do not wish or cannot use complete control

C-1 Learning requirements
- Provide a description of the target audience
- Review the lesson prerequisites
- Clearly present the objective and structure of the lesson
- Explain the criteria for assessment

C-3 Personal control
- Use menu driven structure (if possible) to provide learner control
- Provide a table of contents

S-1 Natural consequences
- Provide for transfer of old skills to new tasks

S-3 Equity
- Insure instructional purpose and content consistency

Generality

A-1 Perceptual arousal
- Use unusual content or events to stimulate attention
- Employ alternative representation to stimulate interest
- Ensure absence of distraction to learner's concentration

A-2 Inquiry arousal
- Pose questions that require student response
- Present problem solving situations or allow learners to create their own
- Employ visuals that ask questions of the learner

R-2 Goal orientation
- Explain importance or utility of instruction
- Allow learners to choose among different types of goals

R-3 Motive matching (adjustments)
Allow learner to choose among goals of various difficulty
Give student noncompetitive option (when information is in a game format
Provide for multiple participant opportunities

C-2 Success opportunities
Provide appropriate difficulty level
Provide for pretest and multiple entry points into instruction

C-3 Personal Control
Allow learner some exit control
Provide learner control over pacing of instruction

S-3 Equity
Ensure instructional purpose and content consistency

Examples

A-1 Perceptual arousal
Avoid dysfunctional attention-getting effects

A-2 Inquiry arousal
Employ sense of mystery by presenting a problem solving situation or context of exploration

R-1 Familiarity
Personalize the examples as much as possible by using personal pronouns or by using familiar people or characters
Embed unfamiliar concepts or abstractions with concrete illustrations in familiar surroundings.
Use "everyday" examples or contexts

R-2 Goal Orientation
Use games, simulations, or fantasies where appropriate when giving examples to provide a sense of purpose

R-3 Motive Matching
Allow the student the option of seeing the examples alone or as part of a game with others
Provide options for group presentations, especially when the examples consist of case studies or role playing sessions

C-2 Success opportunities
Sequence examples in an "easy-to-difficult", "simple to-complex", or "concrete-to-abstract" orientation
Keep the examples within an acceptable range of difficulty to prevent excessive boredom or challenge

C-3 Personal control
Provide learner control over pacing of instruction

S-3 Equity
Ensure instructional purpose and content consistency

Practice and Feedback

A-1 Perceptual arousal
Use audio visual effects to gain learner's attention
Avoid distractions that will interfere with learner's concentration

A-2 Inquiry arousal
Engage learner's interest by eliciting active responses
Allow learners to create their own problems to solve their own
Employ sense of mystery by presenting a problem solving situation or context of exploration

R-1 Familiarity
Personalize the examples as much as possible by using personal pronouns or by using familiar people or characters
R-2 Goal orientation
Use goal-oriented games, simulations and fantasies to provide a sense of purpose
R-3 Motive matching
Provide a scoring system with feedback to stimulate achievement need
Provide for noncompetitive options in instruction
Provide for multiple participant opportunities
C-1 Learning requirements
Explain the evaluation criteria and provide opportunities for feedback
C-2 Success opportunities
Organize practice in an easy-to-difficult sequence
Ensure appropriate learning difficulty level by matching learner's skill level to practice
Insert random uncontrollable events to add challenge
Provide for variable difficulty level
C-3 Personal control
Allow learner to exercise exit control
Give the learner adequate pacing control
Use language that helps attribute success to the learner
S-1 Natural consequences
Include exercises that require application of new skill
Provide for transfer of new skills to subsequent tasks
Include simulations that require use of new skills
S-2 Positive consequences
Establish appropriate reinforcement schedule
Establish meaningful reinforcement schedule
Use rewards for correct responses
Employ judicious awards
Allow for optional reward package
S-3 Equity
Ensure instructional purpose and content consistency
Establish practice and test consistency

Assessment and Closure
R-3 Motive matching
Provide a scoring system with feedback to stimulate achievement need
C-1 Learning Requirements
Inform learner of test conditions (number of items, whether timed, etc.)
C-2 Success opportunities
Control difficulty level by adding a time limit, varying speed of questions, or varying complexity of situation
S-1 Natural consequences
Include test questions that require the application of newly learned skills
Include a simulated application
S-3 Equity
Ensure instructional purpose and content consistency
Make the test consistent with the exercises and practice

APPENDIX B

SAMPLE OF AN
INTEGRATED LESSON BLUEPRINT
FOR AN APPLICATION-LEVEL
PROCEDURE, CONCEPT OR PRINCIPLE

Lesson Instructional Objective(s):

Lesson Motivational Objective(s):

Lesson Prerequisites:

Primary Presentation Form: GENERALITY-EXAMPLE-PRACTICE

Instructional Richness Level:

Motivational Richness Levels: "A":____ "R":____ "C":____ "S":____

Primary Lesson Component:	Secondary Lesson Component:
Pre-Instruction	(LIST PRE-INSTRUCTIONAL ACTIVITIES AND MOTIVATIONAL TACTICS TO BE UTILIZED)
Present the Generality	(LIST CDT PRESENTATION FORMS AND "GENERALITY" MOTIVATIONAL TACTICS TO BE UTILIZED)
Give Examples	(LIST CDT PRESENTATION FORMS AND "EXAMPLES" MOTIVATIONAL TACTICS TO BE UTILIZED)
Provide Practice	(LIST CDT PRESENTATION FORMS AND "PRACTICE" MOTIVATIONAL TACTICS TO BE UTILIZED)
Assessment and Closure	(LIST ASSESSMENT AND CLOSURE ACTIVITIES AND MOTIVATIONAL TACTICS UTILIZED